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PRINCIPLES OF PLANT PROTECTION

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PRINCIPLES OF PLANT PROTECTION

NOVEMBER 30, 1950

MILITARY AND CIVIL DEFENSE
COMMISSION FOR PENNSYLVANIA

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Military and Civil Defense
Commission for
Principles of Plant
Protection

MILITARY AND CIVIL DEFENSE COMMISSION FOR PENNSYLVANIA

201 SOUTH OFFICE BUILDING
HARRISBURG, PENNSYLVANIA

TO THE INDUSTRIAL FACILITIES OF PENNSYLVANIA:

As this pamphlet is being written, the United States is, and has been for several months, at war. Although war has not been declared against us and no enemy has crossed our border, Americans, fighting under the United Nations banner, are dying in battle and billions of dollars are being spent for the defense of our country and the re-arming of our allies.

From the standpoint of civil defense, we are in an alert period. Two other periods may follow, at some future undetermined time. One will be when we are attacked by an enemy, with or without formal declaration of war. The other will be when our homeland is attacked by some form of devastating weapon, such as the atomic bomb. During World Wars I and II the United States was providentially spared from attack on its mainland and afforded vital time in which to prepare for war. Those two wars, however, have demonstrated beyond the shadow of a doubt that the productive capacity of this country, the so-called Arsenal of Democracy, is the backbone of our defense and the defense of our allies. No future enemy will commit the fatal blunder, twice demonstrated, of failing to attempt the destruction of this basic strength with every means available to him. Our present potential enemy is known to have highly developed detailed plans for both individual acts of sabotage, and organized "fifth column" activities, as basic forms of effective attack.

During World War II, the Resources Protection Board, at the request of the War Department, evaluated our production facilities. Its investigations revealed a fundamental weakness in our war production capacity, in that we were frequently dependent upon single plants for the production of from 50 to 100% of our entire national supply of some commodities vital to a modern war effort. There were several hundred plants of this importance, few of which produced actual munitions, or "end products," the criti-

cal items being mostly chemical intermediates, parts, and assemblies.

It must be assumed, for planning purposes, that plants in this category are known to our potential enemy; and since the loss of a very few of them could result in our defeat, it is obvious that plant protection is an essential element of civil defense.

It necessarily follows that civil defense, no matter how highly organized, will be futile, and our plans for the protection of the civil population and its property will be academic, if the war is lost through failure to provide for an adequate plant protection program. All-out attack upon our productive capacity will, therefore, be foremost in the strategy of our enemy. This attack will most certainly continue throughout the war, but will probably begin before the opening of formal hostilities. Accordingly, we must prepare now to meet the weapons which may be employed by the enemy both before and during formal hostilities.

As pointed out by the Munitions Board, Department of Defense, "Distance would limit weapons to those which will be most effective. Since the atomic bomb is the most devastating weapon known, atomic attack must be anticipated, whether from aerial bombs, guided missiles with atomic war heads launched from enemy submarines, or other means. Attacks with toxic agents, chemicals, biological or radiological, are also possibilities." In addition to this type of attack, however, an exceedingly effective pattern for attack is already evident from campaigns against other countries. Full scale efforts will be made to infiltrate our industry and destroy by espionage, sabotage and civil unrest our ability and will to produce and fight. This type of campaign may already have begun, or may begin at any time during the alert period, building up in tempo and intensity as the initial direct attack becomes more imminent. It is realistic to assume that the preparatory campaign may culminate in, or actual hostilities commence with, simultaneous, widespread acts of major sabotage and civil disruption timed to coincide with a surprise attack by direct weapons upon our productive facilities.

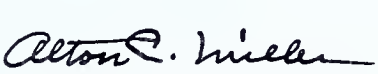
What can be done now by the individual plant operator and his employees to protect themselves and their plants against these hazards? This is a fair question which in their interest and the interest of national defense must be answered. This is the function of the plant protection phase of civil defense.

It is the purpose of this manual to set forth for the managers of Pennsylvania industrial facilities and their employees some

of the means by which enemy action of this type may be minimized or thwarted or the damage resulting therefrom reduced. Much of the material herein is collected from publications on this subject prepared by the National Security Resources Board and the Munitions Board of the Department of Defense.

OFFICIAL

MAJOR GENERAL RICHARD K. MELLON
Commanding



ALTON C. MILLER
Director

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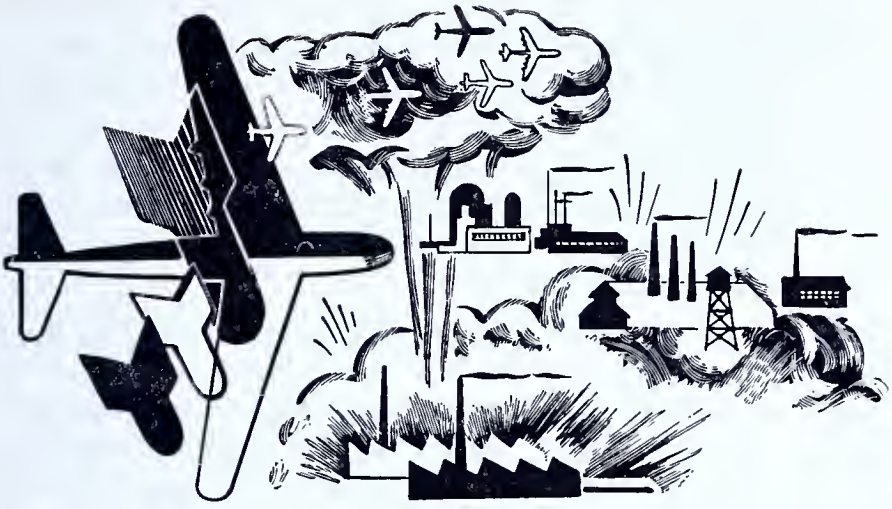


CHAPTER 1

Aims and Purposes

It is the purpose of this chapter to discuss the over-all philosophy of the plant protection program of civil defense and to explain the basic ideas upon which plant protection programs must be predicated.

1. What is Plant Protection? Adequate measures for the protection of industrial production are an essential part of the plan of defense of the nation, taking their place along with military defense. The plant protection program, as part of civil defense, therefore, includes essential steps which may be taken to reduce war hazards to industry and to its personnel. It is elementary that, aside from land invasion, loss of production and personnel in this country can easily result from these well recognized hazards:

a. Direct enemy attack by air, including guided missiles launched from land, sea or air;
b. Indirect enemy attack by sabotage or civil commotion;
c. The results of inherent hazards, such as fire, accident, the elements, and the abnormal and even substandard conditions of wartime operations.

To these hazards must be added espionage, which must precede all direct or indirect enemy activity and which may render production fruitless. A well rounded program dealing with these

hazards must include, therefore, measures which are designed to accomplish one or a combination of the following objectives:

a. To eliminate the cause or minimize the opportunity for the occurrence of hazard;
b. To deal promptly with a hazard which occurs so as to reduce damage to property and injury to personnel;
c. To restore the facility to production as soon as possible after an occurrence.

The program must include all facilities contributing to the war effort, including facilities engaged in furnishing services, such as power, gas, water, transportation, delivery and the like, as well as those producing articles and materials. The reader should keep in mind, therefore, that the term "plant" or "facility" as used in this pamphlet is intended to include service facilities, as well as manufacturing facilities, and may cover a bridge, tunnel, power transmission line, or gas distribution system. The term "product," similarly, will include the services rendered by such facilities.

2. Responsibility for Plant Protection. On the theory that the protection program must be cut to fit each plant, the National Security Resources Board has announced that "Primary responsibility for plant protection rests upon the owners and operators under the principle of organized self-protection. . . . Private managements are expected to provide the necessary protection for their properties and operations." Plant management and plant employees, therefore, become the major instrument for the planning and operation of plant protection programs within their own plants.

Plant operators whose plants were critical to the war effort in World War II may recall that the military services of the Federal Government aided and supervised the establishment and execution of plant protection measures during the war. Under the announced policy of the National Security Resources Board, however, no aid or supervision at plant level may be anticipated during the present or future emergency. The Federal Government has undertaken responsibility for establishing a national defense plan with accompanying policy and the issuance of informational and educational material about both. The respective state governments have been assigned the responsibility of providing leadership and supervision in planning for civil defense and the direction of supporting operations in an emergency. In all matters of civil defense, including plant protection, the Federal Government

will deal directly with the states through their Governors. City and county governments have been assigned the responsibility of establishing local civil defense units under guidance of the Commonwealth Military and Civil Defense Commission. The formulation, activation and application of plant protection measures for any particular plant, however, is the peculiar responsibility of the management and employees of the plant, with such aid, primarily in the nature of disaster relief, as may be attained by coordinating the plant protective organizations with local civil defense units.

3. **Evaluation of Plants.** In order for plant personnel to assume this responsibility, they must first know the yardstick by which plants are measured for protection purposes.

All plants occupy a place in the national economy and will contribute to a greater or lesser degree to the nation's ability to fight. Therefore, the loss of any plant, material, or personnel, is to some degree detrimental to the nation's war potential. On the other hand, plant protection programs consume manpower, materials and money, all of which in times of emergency are in short supply and therefore must be utilized to the greatest possible advantage. Since it is not economically possible or theoretically necessary that industrial facilities, of every kind and character, achieve the same high degree of plant protection, the determination of the degree of protection warranted in any particular plant is predicated upon an analysis of two factors—(1) relative criticality, and (2) relative vulnerability.

4. **Criticality.** The phrase "Relative Criticality" has been coined to describe the relative importance to the war effort of an industrial or non-industrial target. The facility which is considered to be of high criticality is one whose partial or complete loss would have an immediate and serious impact upon the ability of the United States to maintain its defense or mount an offensive. The criticality of a facility may bear no direct relation to its size, the existence of contracts with the military branches of the Government, or whether it produces an end product utilized as a munition of war. A small plant producing or fabricating the sole supply of an essential raw material, ingredient or part, may be of higher criticality than the large plants of a vast industry with widely distributed facilities, the loss of any one of which may not seriously affect the supply of a product. Industrial leaders are fully familiar with the wide-spread curtailment of production often-

times resulting from the disruption of production in a relatively small plant furnishing an essential part or ingredient utilized by many far-flung industries. Similarly, the productive capacity of an entire community supporting many production facilities of greater and lesser criticality may be eliminated by the destruction of essential service facilities such as power, water, transportation and the like. Hence, criticality must be determined upon the basis of the importance of the facility to the whole industrial scheme of which the plant is a unit.

Clearly, as the demand for and supply of materials or services vary with the ever changing requirements of war, the relative criticality of plant units may change accordingly. Thus, a plant producing a high percentage of a particular part of an amphibious machine may have merited an extra high relative criticality ranking immediately prior to the invasion of Europe in World War II, but the same plant may have deserved a comparatively lower rating thereafter. Consequently, the concept of criticality is inevitably a fluid concept requiring continuous analysis and revision of determinations. During World War II, the Federal Government, through the Resources Protection Board, maintained a criticality list and evaluated plants and facilities in accordance with their current relationship to the war effort. At the present time there is no such rating agency activated or planned in the Federal Government. Accordingly, every plant operator must use his own expert knowledge and judgment to determine the criticality of his own plant for plant protection purposes by determining the degree to which the loss of his facility or its damage might affect the ability of the nation to defend itself against an enemy.

5. Relative Vulnerability. Relative criticality indicates how much the loss or damage of a facility will hurt the war economy. *Relative vulnerability* indicates how easily and for how long production or service can be curtailed or stopped. Thus the determination of the vulnerability of a facility is made without regard to the impact of the loss of or damage to the facility upon the war effort.

To differentiate between these two essential criteria, consider the following example. A pile of steel landing mats, each unit comprising a roll weighing approximately two tons, and the aggregate representing the entire available supply at the moment, would merit a high criticality rating. On the other hand, because of the size, weight and composition of the mats, the pile cannot

be destroyed by fire, stolen, or seriously damaged by explosion, except by heavy concentration of high explosives or chemical incendiaries. This critical target cannot, therefore, be appreciably damaged by sabotage or usual enemy action, except heavy, accurate air attack. Accordingly, its vulnerability rating for plant protection purposes is very low. On the other hand, consider a plant manufacturing only a small percentage of the national production of a war material, with the remaining plants well dispersed over the country. Its criticality is low. Within the plant, however, is a condition such that if a small fire is kindled, the entire plant could easily be destroyed. The vulnerability of this plant to fire by any means is high.

6. Criticality vs. Vulnerability. The formulation of plant protection programs is guided by a realistic appraisal of the criticality and vulnerability of the facility involved. It is only logical to assume that the enemy will not attack targets it cannot injure, or expend efforts on targets which are relatively profitless. If, as in the case of the pile of landing mats, the facility is critical, but not vulnerable, or, as in the case of the described maunfacturing plant, it is vulnerable, but not critical, only a moderate degree of protection is required. If, however, a facility is both highly critical and highly vulnerable, then it is the ideal target for enemy action and it can be reasonably assumed that the enemy, if properly informed by his espionage system, will attempt to destroy it. Hence, an extensive plant protection program becomes a necessity.

7. Practical Factors in Plant Protection. A plant protection program, however, cannot be built simply on the academic, though vital, concepts of criticality and vulnerability. These abstract determinations must be measured against practical considerations of cost and manpower before a true evaluation of the breadth of the program feasible to the particular plant involved can be made. These are criteria which plant management is accustomed to applying. Similarly, plant protection planning must be based upon a consideration of the type of plant construction, geographical location, availability of replacement equipment, time and skills required for repair.

The difficulty, if any, which plant management will experience in this phase of planning is in measuring the return from expenditures of money and manpower for plant protection against the return from other demands clamoring for the same investment. Here management must sit in final judgment. The situation and

problems of each plant are so unique that it is not possible to furnish a sensible guide or test to aid in this evaluation.

Certain considerations, however, bearing upon this evaluation require emphasis:

a. The stakes are large. The pay-off may be in terms of lives saved, business preserved, a war won. Insurance programs may protect the plant and its personnel from financial loss in the event of catastrophe, but insurance does not replace men or production.

b. Plant protection measures will seldom demonstrate their real value until the enemy's effort is made. It is then too late to improvise.

c. The risks are *real,* not speculative. The question is not whether there *is* a danger, but solely how *imminent* is the danger.

Obviously no plant can establish protection capable of preventing or overcoming the effects of all disasters. But with proper knowledge of principles, every plant can apply some techniques and procedures which will materially protect the plant and its people at reasonable cost from many of the hazards of peace and war.

CHAPTER II

Hazards to Industry

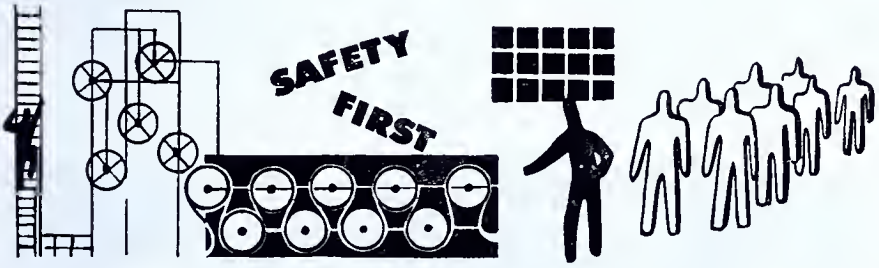
The hazards to industry embraced in the plant protection program are the following, listed in the order in which they are most likely to occur:

1. Hazards inherent in production operations.
2. Espionage.
3. Sabotage.
4. Direct enemy attack.

The hazard of direct enemy attack may be further subdivided as follows:

a. Air Attacks
b. Chemical
c. Biological

It is the purpose of this chapter to discuss briefly the components of these varying hazards. The preventive measures which may be applied to protect against such hazards are discussed in the following chapters.



1. Hazards Inherent in Production Operations. Plant protection is not confined to meeting the most hazardous situations; it is a continuing activity beginning in peacetime and expanding to meet the spectacular hazards of formal hostilities. The present world crisis has precipitated a defense program during which a great deal of industry may be converted to production of war items, even though this country is not officially at war. This increased or converted production naturally intensifies the routine hazards.

A safety and welfare program to combat routine hazards is the first requirement of any plant in peacetime or war. Most plants have such a program organized to the extent necessary for the size and type of plant. Therefore, no attempt is made here to describe such systems in detail. The importance of having a well-organized safety and welfare system cannot be over-emphasized, however, because it is the nucleus or foundation for a broader protection program. Employers who are establishing new companies or who have never inaugurated a general safety program can obtain guidance from various sources, expert in this field.

Specific peacetime hazards depend on the industrial process, the plant lay-out and construction, and the amount of organized protection and prevention enforced by management. Many of these hazards and effects are the same as those brought about by war, and, therefore, require the same methods of prevention and control, except on a smaller scale. Some of the more common ones are accidents, fire, disease and illness. Management is normally aware of this type of hazard, and, to the extent practicable, has in operation protective systems. While the installation of elaborate safeguards is obviously impractical for small plants, the full capacity production usually resulting during emergency periods will ordinarily increase these normal hazards. Substitute or inferior material may be used; improvised and unfamiliar processes and techniques may be inaugurated; inadequately trained workers are employed; or an excessive load may be placed upon power, water, sanitation, and other facilities of the plant. Consequently, management must be alert to recognize that the increase in risks concurrently makes more desirable, and therefore more practical, a corresponding increase in protective measures.

2. Espionage. Espionage is the foundation upon which all enemy action must be based. An atomic bomb, for example, no matter how terrific its destructive potentiality, is useless without a worthwhile target. Furthermore, the enemy cannot risk trained

men, expensive equipment, and costly munitions unless the destruction of the target selected offers adequate profit in terms of decreasing our ability to wage war. Since it is reasonable to assume that the opening of the next war will be heralded without advance warning by attacks upon our vital installations, it follows that the prospective enemy is now and will be continuously endeavoring long prior to the actual attack to ascertain where and what those facilities are. He will further endeavor continuously after the initial attack to obtain the same information in order to mount additional attacks.

All plant personnel are generally well acquainted with the notorious type of espionage characterized by professional spy rings. Such espionage, while glamorous and effective for limited purposes, does not produce for the enemy, or prospective enemy, the vast mass of detailed, accurate information concerning the vital facilities of this country which is necessary to destroy systematically our productive might. Of far greater importance is the accumulation of detailed data respecting the manufacturing, transportation, utility and service facilities of this country, their products, and their interdependencies. This data may only be derived piecemeal through contributions by a multitude of relatively insignificant agents whose fragmentary reports fit together like pieces of a jigsaw puzzle to complete a precise picture of our industrial and civilian war structure.

a. Information sought. Specifically, the following information is frequently sought:

(1) Capacity, rate of production, industrial mobilization schedules, and details of orders on hand.
(2) Plans and specifications of articles produced.
(3) Test records of newly developed items.
(4) Sources of raw materials, components, intermediates, parts and assemblies.
(5) Destination and quantity of completed units and transportation routes.
(6) Data on production methods and processes.
(7) Critical points and possible methods of effective sabotage.
(8) The plant protection plan, or details thereof, such as, measures in force to prevent sabotage, frequency of inspections by guards and their dependability.
(9) Dissatisfied labor elements that might be employed in subversive plans.

b. Methods. Espionage agents may be expected to use great ingenuity in obtaining information. Examples are—

(1) Infiltration into plants as employees, visitors, inspectors, or service men.
(2) Obtaining information from employees by (a) stealing, (b) purchasing, or (c) encouraging them to "talk shop."
(3) Stealing information from records or other sources and reporting personal observations and studies of production operations, test runs or classified materials.
(4) Using various means of reproducing documents, products, processes, equipment, or working models.
(5) Using "fronts," such as commercial concerns, travel agencies, import-export associations, scientific organizations, insurance agencies, businessmen's groups, and other organizations to obtain confidential information or pertinent statistical information which can be translated into strategic information.
(6) Using threats of danger to friends or relatives of an employee to obtain information.
(7) Skillful extraction of information from members of the family or close friends of an employee.
(8) Picking up information in social gatherings.

3. Sabotage. Although the convictions for violation of the Sabotage Act during World War II were numbered in the thousands, there was no legal proof that these cases were enemy directed; but to adopt the view that no such sabotage was attempted, or succeeded, or that no such sabotage would be attempted in a future war, is highly unrealistic. It is known that the enemy in World War II landed trained saboteurs in this country. The fact that no damage in the last war was directly traceable to enemy sabotage may well be attributable to the ingenuity exercised by the enemy in the direction of sabotage and the selec-

tion of sabotage methods rather than to his failure to appreciate the necessity for this form of warfare. Industrial sabotage is a basic doctrine of the Communist party and other revolutionary bodies. The undeniable existence of this doctrine, the highly effective results which may be accomplished by the skillful employment of sabotage, and the known existence of substantial groups within this country available and willing to undertake such work places this hazard higher upon the list of risks confronted by our industry than at any time in the history of this country.

In terms of trained manpower, equipment, and munitions risked, a sabotage operation involves only negligible expenditure by the enemy, but the profit may be enormous if the target has been strategically selected. The disastrous consequences of a minor act of sabotage, such as the destruction of a critical power transmission unit, may be grossly disproportionate to the manpower, time, or material devoted to the act. It is only realistic, therefore, to assume that the outbreak of a formal attack on this country may be accompanied by one or a series of well planned major sabotage efforts. In addition, however, throughout the period prior to the initial formal attack and thereafter, tremendous loss may be occasioned by a multitude of small acts whose cumulative effect may be of greater significance than an initial or subsequent major sabotage plan.

a. Methods of Sabotage. The tools and methods of sabotage are limited only by the skill and ingenuity of the saboteur. A major sabotage effort may be undertaken after thorough study of the physical layout of the plant and its production processes by technical personnel fully qualified to select the most effective vehicle to strike one or more of the most vulnerable parts of the plant. Sabotage may, on the other hand, be improvised by the saboteur relying solely upon his own knowledge of the plant and the materials available to him. The saboteur, in such a case, may or may not possess a high degree of technical knowledge. Hence, the device or agent selected for sabotage may range from the crude or elementary to the ingenious or scientific. The methods of sabotage may be generally classified as follows:

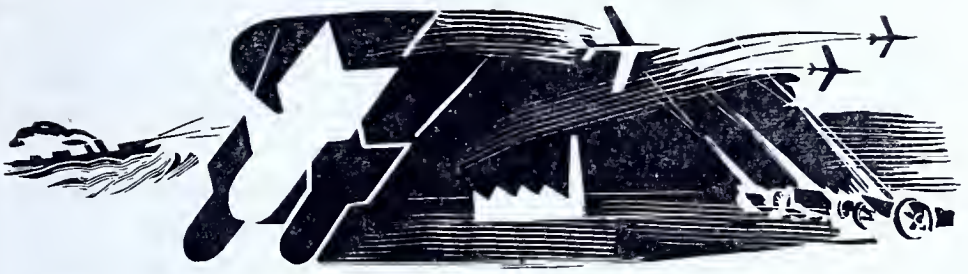
(1) Mechanical—breakage, insertion of abrasives and other foreign bodies, failure to lubricate, maintain and repair, omission of parts.
(2) Chemical—the insertion or addition of destructive, damaging or polluting chemicals in supplies, raw materials, equipment, product, or utility system.

(3) Explosive—damage or destruction by explosive devices or the detonation of explosive raw materials or supplies.
(4) Fire—ordinary means of arson, including the use of incendiary devices, ignited by mechanical, chemical, electric or electronic means.
(5) Electric and Electronic—interfering with or interrupting power, jamming communications, interfering with electric and electronic processes.
(6) Psychological—the fomentation of strikes, jurisdictional disputes, boycotts, unrest, personal animosities, inducing excessive spoilage and inferior work, causing "slowdown" of operations, provocation of fear or work-stoppage by false alarms, character assassination; on a larger scale, the instigation of false political and economic public issues and the dissemination of inflammatory propaganda so as to break morale.

b. Objectives of Sabotage. The objectives of the saboteur in a particular plant may include one or more of the following:

(1) Damaging buildings and production equipment.
(2) Damaging power, communications, water, and sanitation systems.
(3) Tampering with gages, precision tools, and testing devices.
(4) Tampering with drawings, formulae, or working models.
(5) Infecting or polluting water and foodstuffs.
(6) Tampering with ventilating systems or polluting the air supply.
(7) Tampering with personnel safety devices and equipment and otherwise creating conditions which would injure personnel.
(8) Damaging, spoiling, or destroying the product of the plant.
(9) Sabotaging manpower by use of psychological methods discussed above.

A definite distinction must be made, however, between manpower sabotage by psychological means, such as the fomentation of strikes, "slowdowns," and the like, and legitimate labor activities. Manpower sabotage of this nature is extremely difficult to detect. One disloyal employee engaged in psychological sabotage may influence others who will thereupon, believing in good faith that a labor grievance exists, engage in strikes and other activities resulting in loss of production.



4. Enemy Attack. At the immediate outset of any future war and continuously thereafter it is certain that, in addition to sabotage, the enemy will attack the vital facilities of this country with the most effective weapons available to him. Obviously the responsibility for preventing or minimizing such direct attack rests primarily with the Armed Forces. While plant personnel cannot know in advance the nature or capabilities of the enemy's striking force for this type of attack, it is reasonable to anticipate that such attack may proceed initially or from time to time after the outbreak of the war along any of the following possible lines:

a. Air Attack
b. Chemical Attack
c. Biological Warfare

While the primary problem in the event of such attack is for disaster relief and control of damage, measures may be undertaken by plant personnel which will lighten the effect of such attack.

a. Air Attack.

(1) *The atomic bomb.* The best available information on the atomic bomb is contained in "The Effects of Atomic Weapons" prepared jointly by the Atomic Energy Commission and the Department of Defense and "How to Survive an Atomic Bomb" prepared by Richard Gerstell, Ph.D., Consultant, Civil Defense Office, National Security Resources Board. The following summary of the effects of atomic bombs as published by the Department of Defense, Munitions Board, will be important in planning:

(a) *Blast.* The explosion of the atomic bomb in air produces a pressure wave of high intensity followed by a wind resulting from the outward physical displacement of the mass of air surrounding the explosion. The pressure in the wave which en-

gulfs a building has the effect of crushing it and at the same time the lateral component force tends to push it over. There may be complete collapse, or lesser damage with failure of windows and weaker portions of the structure.

Personnel may be killed or injured by collapse of structures or by flying missiles such as glass, bricks, or displaced equipment. The injured may be pinned down by debris or not physically able to leave the damaged building and may, if not removed, die as a result of fire or lack of first aid. Equipment may be damaged as a result of distortion of the building or by flying missiles and by exposure to the elements if not covered promptly after an attack. The human body is capable of withstanding extremely high blast pressures and the number of casualties from direct blast effects may be expected to be rather small.

(b) *Fire.* Radiant heat of great intensity but short duration from the atomic explosion will start many fires. Combustible materials which absorb a large proportion of the heat and dissipate a small amount from the exposed surface are more frequently ignited. However, there are so many factors involved that generalizations are open to question. Fabrics, very thin sections of combustible material, and splintered wood may be expected to catch fire as a result of exposure to radiant heat. Blast is a secondary cause of fires by rupturing gas mains, causing short circuits, damage to furnaces or ovens. Fires of this type may be caused at much greater distances than those by radiant heat. Persons exposed to radiant heat may be badly burned but any protection, even that of clothing, will reduce the degree of injury. Only those employees working in the open would be likely to be burned severely.

(c) *Ionizing radiation.* The hazards from the effect of ionizing radiation have been somewhat exaggerated in the public mind. Casualties caused by radiation constituted only 15 to 20 percent of the total in Japan and more effective methods of treat-

ment have been developed for radiation sickness that will reduce the hazard.

(d) *Radioactive contamination.* An underwater or underground burst would cause a considerable degree of contamination which might constitute a serious hazard to persons remaining in the area because of the exposure to radiation and the chance of ingestion or getting radioactive particles in the blood stream through cuts or skin abrasions.

(2) *High explosive and fragmentation bombs.* High explosive bombs produce, on a lesser scale, the blast and fire damage involved in an atomic bombing. A study of bombing results in Europe indicates that a tremendous weight of bombs was required to destroy completely a factory building. Generally, damage was greater where the roof was supported on side walls than where the building was of steel or reinforced concrete frame construction. Such bombs were, in addition, responsible for destructive fires, particularly where the explosion caused leakage of gases, oils, and other combustible material. When used in large numbers, the over-all effect may be roughly comparable to that of an atomic bomb so far as fire and blast damage are concerned, though damage to buildings will be more localized in character and the danger of collapse lesser. Injury to personnel and equipment will also result from fragmentation and from flying debris.

Smaller fragmentation bombs may be utilized against personnel and vehicles, including railroad and marine equipment. Such bombs will not result in any substantial damage to buildings, however, for they are fused to explode on contact, thus limiting the building damage in general to the roof rather than walls and equipment.

(3) *Incendiary bombs.* Incendiary bombs were proven during the last war to cause five times as much fire damage as high explosive bombs. In an incendiary attack, fires start concurrently in buildings over a large area and in a mass attack spread with incredible velocity to produce "fire storms" or "conflagrations."

The phenomenon of the "fire storm," occurring in the absence of a strong ground wind, is caused by the

inward draft of air at ground level to feed the fire. This inrush of air from all directions toward the fire center reaches hurricane velocities and may result in independent tornadoes which will break off and sweep through surrounding areas. In such fire storms, temperatures of all combustible materials in the fire area are raised to the ignition point and a complete burn-out occurs. The fire-wind itself, however, confines the fire and thus limits its spread. Fire fighting cannot be effective within the storm area, but is effective on the perimeter of the storm.

The second type of mass fire is the "conflagration." In the presence of a strong ground wind, a potential fire storm will become a conflagration. The conflagration will wreak even greater havoc than the fire storm for an extended wall of fire will proceed before the wind until it has engulfed all combustible material within reach. On the windward and parallel sides of a conflagration, fire fighting can be effective.

(4) *Guided missiles.* The feasibility of attack by guided missiles has not been clearly determined. However, the threat of damage from such an attack, depending upon the war-head employed and the number of missiles involved, will be the same as if the missiles were delivered by air attack.

b. Chemical attack. It is conceivable that the enemy may have developed toxic gases and means of delivering them in effective quantities. Volatile gases, easily dispersed by the wind, are not likely to be employed unless such gases are effective in very low densities. It seems probable, therefore, that any gas employed in this type of operation will be a heavy gas, clinging to and contaminating surfaces, or forming pockets in depressions or subsurface areas. The degree of hazard involved from this type of attack must be determined by future developments.

c. Biological warfare. Biological warfare is an attempt to use disease germs for purposes of war. Actually this weapon has never been employed on a large scale by any nation, but its potentialities have been recognized by the Department of Defense and it is known that various nations of the world have given considerable study to its use in warfare. In World War II, Military Intelligence reported attempted biological attacks, both in China and Burma; and there is some evidence that an experimental attack

occurred within the United States. Evidence of research in this type of warfare has recently been discovered in North Korea.

Bacteriological or biological attacks will be made by polluting the air, water, food, or some part of the surroundings of the populations with disease germs so that food shortage or contamination, or wide-spread public disease will result. Such attacks could be made by air, by missile, or by some form of sabotage. While the dissemination of bacteria in clouds by bomb or missile is not to be dismissed, the intense polluting of surroundings required to do extensive damage in a general air or missile attack indicates that under present circumstances sabotage would be the most effective method of delivering this weapon. A typical sabotage operation might involve the dissemination of disease germs by contact, by infecting water systems, milk supplies, animals, crops, bulk food supplies, or air circulating systems, or by interfering with normal safeguards, such as intentional stoppage of the chlorine additions to public water supplies.

CHAPTER III

Plant Protection Measures

1. General. In the preceding chapter it was observed that, aside from direct enemy attack, the major threats to plant property and production flowed from espionage, sabotage, and the hazards inherent in production operations. Accordingly, plant protection programs should be designed to achieve security of information and prevention of sabotage, and to reduce lost time and damage occasioned by ordinary operating hazards such as fire, accident, disease, or illness.

2. Graded Protection. Clearly the scope and character of the program to be employed in any plant must be no more extensive and no more limited than is warranted by an evaluation of the following criteria:

a. The imminence of attack.
b. The criticality of the plant.
c. The vulnerability of the plant or its equipment.
d. The practical limitations imposed by the physical characteristics of the plant, and the availability of capital.

Accordingly, each plant must continually evaluate its position in the light of the foregoing factors and devise plant protection plans consistent therewith. The greater the criticality of the plant and the more vulnerable the essential parts of the facility, the more intensive and extensive must be the programs adopted for its protection. Similarly, as the imminence of formal hostilities increases, plant protection programs should be stepped up so that at and after the outbreak of formal hostilities all plant protection measures deemed necessary, in the light of the criticality and vulnerability of the plant involved, will be in full operation. It must not be forgotten, however, that the criticality of a plant may vary from time to time as its product or products become more or less essential to the national defense, or its share of the total of the nation's production of a critical product becomes greater or lesser. Further, it must not be overlooked that the strategic importance of a plant does not necessarily turn upon

whether it is producing a munition or weapon. The criticality of a plant producing a raw material, chemical ingredient, component, part, or assembly may be greater than the criticality of one of a number of plants producing an actual munition of war, for its product may in the industrial process be vital to a large number of plants producing a variety of munitions or weapons.

To the abstract conclusions reached by application of the foregoing standards, plant management must, of course, apply the realistic test of its financial ability to buy all or such part of the protection measures as this analysis may have shown to be desirable for its maximum protection. No uniform plant protection program may be devised in advance for all plants, and each plant must devise its own program graded in the light of the foregoing criteria.

It is the purpose of this chapter, therefore, to present a summary of the varying types of plant protection programs which may be inaugurated, to the end that each plant may select therefrom from time to time such measures in part or in whole as may under the circumstances be determined to be necessary and feasible.

At the date of this writing, however, it is the judgment of the Military and Civil Defense Commission for Pennsylvania that for purposes of this selection, plant personnel should assume the present period to be a time of alert during which actual hostilities may be opened at any time and should base their selections upon this premise.

3. Protection against Espionage and Sabotage.

a. Employee Assistance. Employees are in a very favorable position for the accomplishment of espionage and sabotage. On the other hand, the most effective single protective factor against these same hazards is the understanding and aggressive alert cooperation of all loyal employees. It is unquestionable that the vast majority of employees are patriotic and anxious to con-

tribute whole-heartedly to the protection of their plant. While management is primarily responsible for the safety of plant property, labor has an even more vital and personal interest in protecting itself from injury, loss of life, or loss of livelihood through the activities of subversives. In a recent instance in the Midwest, the employees of a plant producing combustible gas joined in a demand that subversive elements be removed because their presence constituted a constant menace to the lives and safety of all concerned. Consequently, each loyal employee is a personally interested assistant in the successful operation of plant protection programs. The value of this great reservoir of assistants is incalculable, for as a group, they—

(1) Know all details of operations more completely than either plant management or undercover men;
(2) Know their fellow workers far more intimately; and
(3) Can be trained to exercise an ever-present and all inclusive surveillance.

Thoroughly effective cooperation of employees cannot be expected or secured without education and training in the problems involved and the discipline essential. The more important points relative to which employees should be educated are—

(1) Willing acceptance of the unpleasant fact that all employees must be inconvenienced by the many rules and regulations designed to trap or thwart the few subversives.
(2) The dangers of talking business away from the job.
(3) The dangers of hysteria and disaffection which may be inspired by subversive organizations.
(4) The dangers of spreading unconfirmed rumors.
(5) The detection and reporting of trespassers.
(6) Observance of suspicious characters and their actions.
(7) Avoidance of unwarranted approaches by strangers anywhere.
(8) Avoidance of association with dubious characters.
(9) Avoidance of suspicious promotional offers involving lurid business or financial opportunities.
(10) Noting and reporting unusual equipment failures and accidents.
(11) Familiarity with the tactics of spies and saboteurs.

To be effective, educational work of this character must be continuous. Furthermore, it must be sufficiently appealing to capture

the interest and imagination of the employee. Experience indicates that the most effective form of education is the informal, on-the-job instruction conducted by the employee's immediate supervisor. Here it is possible to use actual, everyday examples to illustrate general principles, thus fixing the problems and responsibilities more firmly in mind than by depending entirely upon classroom or textbook instruction. The written text usually serves better as reference material for the supervisor than for the employees whom he instructs.

b. Personnel Loyalty Determination. Since disloyal employees may so easily commit espionage and sabotage, measures to assure the loyalty of employees are of extreme importance during a period of alert and during actual hostilities. Investigation of actual or suspected espionage or sabotage is a function of the Federal Bureau of Investigation of the United States Department of Justice. It must not be assumed that the Federal Bureau of Investigation will, either directly or indirectly, inform management or plant security personnel of subversives or suspected subversives employed in private industry, even in those cases where the plant management has signed the secrecy agreement with a federal procurement agency. Accordingly, self-sufficient procedures for loyalty determination must be incorporated by the plant in its standard personnel policies. The only thorough procedure is actual investigation of all employees or, at least, of each employee engaged in the handling of data or information of importance to defense or occupying a key position within the plant. Since such actual investigation will not be economically feasible in the vast majority of cases, the following measures may be taken, which may not be wholly satisfactory but will afford substantial aid to the employer in carrying out this responsibility.

(1) *Scrutinize Sources of Employment.* Sources from which employees are recruited should be carefully considered. If applicants are referred to the plant by an employment agency, trade, or other organization, a responsible official of the plant should personally investigate the recruiting source to assure himself of the character, reputation and competence of those in charge. Standards for the selection of applicants should be adopted and made clearly known to the agencies referring job applicants to the plant.

(2) *Employee Application Forms.* Adequate application forms for any position should be completed by every ap-

plicant therefor before the applicant is considered for employment. The information solicited on such forms should include at least that required by reputable personnel investigating agencies. In addition, the plant may well consider the advisability of annexing to the application a form of affidavit by the applicant certifying that the applicant has not been and is not a member of any organization, or subscriber to any political doctrine, advocating the forcible overthrow of the Government of the United States or advocating or intending physical or other obstruction of its Armed Forces.

(3) *Employee Reporting.* Procedures may be established for the confidential receipt of information from loyal employees. Keeping paramount in mind the likelihood that such reports may be inspired by personal animosity and may be based upon rumor rather than fact, an effort should be made to verify the ground or basis for such information. If such investigation indicates a sound basis for suspicion of actual espionage or sabotage, then the incident involved should be reported immediately to the nearest office of the Federal Bureau of Investigation. In order not to prejudice the investigation of the incident, further steps should not be taken at this stage except after consultation with the F.B.I. agent in charge. Unless criminal prosecution results, however, the plant may reasonably assume that no affirmative protective action will be taken by the F.B.I. or any other governmental agency and that the responsibility for measures for the protection of the plant must be assumed by the plant personnel.

(4) *Suspension or Containment of Subversives.* If the plant is critical to the rearmament or war effort and there is reasonable suspicion that an employee is inclined to be subversive or to associate with known subversives, then the plant should take appropriate steps to eliminate a threat of sabotage or espionage by such suspect. Such steps may be taken either (i) by discharging the employee, or (ii) by transferring the employee to a position where it is sure that he will not have any opportunity for espionage or sabotage. The responsibility for such action must be unshirkingly assumed by plant management and plant labor for the protection of their mutual

interests. Accordingly, it would seem highly advisable for labor and management to collaborate in the establishment of orderly procedures to handle such discharges or transfers, affording adequate protection to the personal interests of the employee as well as to the common interests of labor, management, and the national defense. Where collective bargaining prevails, these procedures may well be established in the collective bargaining contracts between labor and management.

(5) *Aliens.* The employment of aliens is a prerogative of management and, of course, the mere fact that the applicant or employee is an alien will not necessarily mean that he is adverse to the objectives of this country. On the other hand, management should exercise caution in the selection of aliens, for the employment of numbers of aliens will obviously increase the chances of the introduction of foreign subversive elements into the plant.

In addition, where the plant has an aeronautical or classified contract with a Federal department, the permission of that department must be obtained under existing law before an alien may be employed in connection with that particular contract. Permission will be obtained by submitting an alien questionnaire in the form prescribed by the department, meeting security requirements prescribed by the department, and obtaining the written consent of the Secretary of the department concerned.

c. Safeguarding Classified Information. Classified information is that information which is classified by the governmental department concerned as "restricted," "confidential," "secret," or "top secret." When released to a civilian organization, the following legend is generally stamped thereon—

> "This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32, as amended. Its transmission or revelation of its contents in any manner to an unauthorized person is prohibited by law."

Management is responsible for the security of classified information which may come into its possession. Security regulations furnished by the governmental department releasing such information to management must be complied with in full. The Department of Defense will generally advise with regard to methods of

safeguarding such information, but active vigilance on the part of management, coupled with alert anticipation of the avenues by which the information may be obtained under the circumstances prevailing in the particular plant, must be employed to supplement the standard procedures prescribed in such regulations. Extraordinary attention should be paid to employees handling such information, not only as regards their loyalty, but also as regards their discretion and susceptibility to bribery or blandishment. Some of the administrative precautions which should be employed are as follows:

(1) Persons handling classified information should be separated from other employees and should work in areas where absolute security can be maintained.
(2) When not in use, classified information should be preserved in locked combination safes. Safe combinations and keys to restricted areas should be issued only to a limited number of trusted employees. Safe combinations should be changed frequently and should be changed immediately whenever any person knowing the combination leaves the firm.
(3) Control of the number of copies of correspondence, plans or other documents containing classified information must be exercised to assure that extra copies are not made and delivered to agents outside the plant.
(4) Waste paper from administrative offices, engineering departments, drafting rooms and blueprint rooms and other departments using classified information must be disposed of by burning or shredding so that no classified material can be salvaged and used. Janitors and charwomen, due to their access to all parts of the plant, have unusual opportunities to obtain classified information and by reason of low salaries may have more than ordinary inducement to do so. Such persons should, therefore, be kept under reasonable surveillance.

d. Safeguarding Unclassified Information. Information originating within the plant may be of as great importance to the espionage agent as information released by governmental departments to the plant. Unless the origination of such information is directly under the supervision of a governmental department it may not be formally classified. Such information, however, should be protected with the same zeal and by the same procedures accorded classified information. Management, in the exercise of

sound discretion, must assume responsibility for its own classification of such material and its protection against espionage.

e. Control of Personnel and Visitors. Efforts to assure the loyalty of employees may be wasted if adequate measures are not taken to enable the ready detection by employees of a stranger in the plant, or an employee outside of his authorized area. Accordingly, the entry of visitors should be controlled and all visitors and employees should be identified and their movements regulated.

(1) *Visitor Control.* Visitors should not be admitted to the plant except for a legitimate purpose and then only to areas wherein their specific business must be transacted. This restriction should apply to all persons whether the particular person represents industry, government, or the military services. Procedures should be established by which visitors are admitted only after the approval of a responsible plant official. Special regulations for the control of visitors at plants working on classified contracts for the Federal Government are set forth in Army Regulations 380-5, U.S. Navy Security Manual, and Air Force Regulation 205-1.

In time of actual hostilities, visitors may well be restricted to the following, or similar categories:

(a) Federal, State, and local officials, duly identified and accredited, performing official duties.

(b) Firemen, policemen, physicians, nurses, and relief authorities in an emergency, but precautions should be taken to prevent persons from taking advantage of the confusion created by the emergency to effect an unauthorized entry.

(c) Persons essential to production, such as repairmen, accredited insurance company inspectors, and technical consultants, after adequate identification.

(d) Salesmen, applicants for employment, and other casual visitors only to non-critical areas and then only under strict limitations which will reduce risks to negligible proportions.

(e) Visitors specifically approved by responsible governmental intelligence agencies.

Each visitor should be prepared to identify himself and, in plants engaged on classified projects, to show that he is a citizen of the United States. In time of hostilities, the visitor should be requested to display a card

or statement, prepared by his employer which adequately identifies him, and if necessary, indicates that he is believed to be a loyal citizen of the United States. If the plant is highly critical or classified information is being handled, it will be desirable, in the event of actual hostilities, to exclude from the plant any visitor whose identification card does not contain the following minimum information:

(a) Personal characteristics, such as name, height, weight, color of hair and eyes, race, birth date, distinguishing marks.

(b) Photograph, print of one or both thumbs or index fingers, and signature.

(c) A certificate, signed by an authorized official of the visitor's employer, that the information contained on the card is correct, that the person identified is the employer's representative, that information, verified to the satisfaction of the signator, has been presented, that the person identified is loyal to the United States.

Such identification cards should be treated as identification only, however, and should not be deemed as a pass or to confer authority on the holder to visit the plant or facility no matter by whom the card is issued.

A visitor's record should be maintained showing for each visitor the following information: his signature, address, explanation of purpose of visit, time of entry and departure, name of plant officer granting admission, and whether or not the visitor had access to classified material.

(2) *Identification System.* In small plants personal recognition by fellow employees functions as an ideal solution of the employee identification problem. In larger plants, however, employee identification systems must be established, and in all plants measures should be taken to identify authorized visitors. The most practical method is by identification card or badge. A badge pinned to the clothing is preferred because it is visible at all times and the least likely to be lost. The badge system should meet the following requirements:

(a) The badge should be of tamper-proof design and construction.

(b) It should include a photograph and descriptive information sufficient to identify easily the wearer.
(c) Make-up and issue should be rigidly controlled to minimize counterfeiting or theft and to insure return upon termination of service.
(d) Every employee should wear his badge in a uniform place on his clothing at all times within the plant area.
(e) Visitors should be issued special badges or passes.

(3) *Restriction of Movement.* Despite all precautions taken, enemy agents or subversives may obtain employment within a plant, or may obtain authorized entry as a visitor, or may forge or steal identification cards or badges. In critical plants or plants handling classified information, restriction of movement is a necessary supplement to visitor control and identification systems. In very large plants, an individual badge should be valid only for one shift or for one section of the plant. A badge system using different colored backgrounds will help spot an employee out of his own department, or in the plant during an unauthorized period. Similarly, different colored badges may disclose a visitor upon unauthorized areas for which his business furnishes no excuse. Such an employee or visitor should be challenged by the nearest person. Special passes signed by a foreman or superintendent may be utilized to authorize special entry or to identify an employee entering or leaving at off-shift hours.

Restriction of movement may also be assured by issuing a distinct badge to the various classes of employees, the colors or shapes indicating the degree of freedom of movement within the plant.

(4) *Restricted Areas.* Power plants, compressor rooms, switch and transformer rooms, experimental laboratories, rooms containing classified plans and documents and rooms in which critical material is being stored or processed may well be termed vital areas and entry thereto separately restricted. Entrance to such areas may be guarded if necessary, and access thereto be permitted only by special authorization of a responsible plant official.

(5) *Enforcement.* No identification or control system is bet-

ter than its enforcement. It is probable that an enemy agent will be revealed, not by a glaring fault, but by a minor error. Rigid enforcement and alertness is, therefore, a necessity. Enforcement must rest primarily on the foreman and employees, but this responsibility may be shared with the plant guards where guard forces are maintained.

f. Protection against Unauthorized Entry. The prevention of sabotage or espionage not only involves control of the agent operating from within, but the denial of access to the plant from agents outside the plant. The prevention of sabotage or espionage efforts by outside agents will require direct preventative measures.

(1) *Physical Protection:* While police or plant guard protection is the most effective way of limiting or preventing sabotage or espionage from without, practical considerations may eliminate the use of an active guard force. In any event, economy will dictate that all available physical measures of protection be provided to reduce the size of the guard required. The following physical protective devices are useful—

(a) Fencing is an effective barrier.

(b) Special electronic devices are available to detect intruders.

(c) Entrances should be kept at a minimum and locked or guarded at all times. Consideration should be given to the location of entrances so that employees will not have to walk unnecessary distances to their jobs.

(d) Screening should be used on all vulnerable windows, ventilators, drains, or other small openings. Suitable barriers should be erected where access might be possible from adjacent buildings or roofs of buildings, overpasses, etc.

(e) Special physical protection such as fences, walls, lights, and alarms should be given to key machines and equipment, particularly those which are hard to replace, where damage would seriously affect production. Examples are special machines, switchboards, transformers, regulator stations, power terminals, etc.

(2) *The Guard Force.* No physical barrier is fully effective unless backed up by human observation. Fences, locks, and bars will delay, but will not stop a determined intruder. Normally, guards will be the principal means of enforcement. Stationary guards are required at all unlocked entries. Roving guards are utilized to patrol all other vulnerable points of possible entry. Department foremen should be held responsible for all visitors to areas under their control.

Guards and watchmen should make regular nonscheduled patrols of the entire plant on a 24 hour basis. Their rounds should be arranged to cover the interiors and exteriors of all important buildings. Watch-clock stations should be so located that all points of the plant and yard will come under the observation of a guard or watchman on each round.

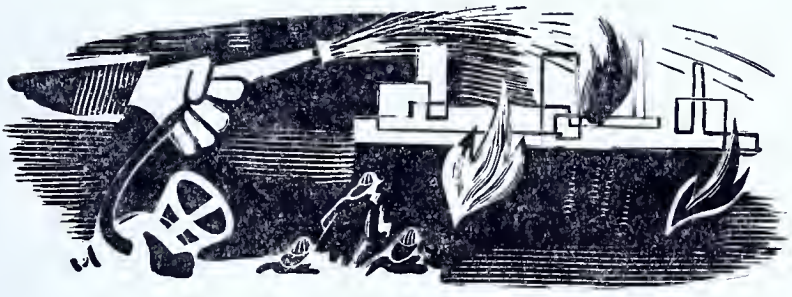
Fences should be inspected on each round and watch should be kept for persons or equipment that might be involved in sabotage attempts. Locked gates and entrances must be checked and any abnormal condition immediately reported.

Trucks and railroad cars should be checked by guards at points of entrance. In important plants, guards should be stationed at receiving and shipping platforms to keep unauthorized persons away and to make sure that no instruments of sabotage are brought in or shipped out. The contents of all incoming and outgoing packages and vehicles should be carefully examined.

In general, guards should have no duties other than the maintenance of plant protection. In small plants, however, watchmen may sometimes serve as wardens, assist firemen, start process heaters or furnaces, etc., provided such duties do not interfere with their regular rounds or other guard functions. Where guards also serve as fire-fighters, sufficient time should be allowed for adequate training in both duties.

Parking lots should be outside the plant yard, but if within or adjacent to plant areas, they should be separated by fencing so that all employees and officials must enter through pedestrian entrances. All persons entering the plant by automobile should be *positively* identi-

fied and the automobile checked. Visitors who are not personally known should be required to park their cars outside the regular parking area in a place specially provided for them.



4. Fire Protection.

a. General. Fire is the single greatest destroyer of property. A substantial fire risk is inherent in practically all forms of manufacture. Even in World War II, when tremendous emphasis was placed on keeping plants operating, fire did tremendous damage. Today fire continues its ravage of industrial properties. Only recently fire destroyed a plant making turbine blades for airplanes. Strangely enough, the source of the fire was one well known to fire prevention engineers and one for which recognized protective devices were readily available. The plant simply did not do an obvious fire protection job.

Most manufacturing fires and explosions are preventable. The major reasons why fire prevention programs are not fully exploited in all facilities are probably the following:

(1) Personal fire experience is too thinly spread to have much educational value.

(2) Plant management sometimes is insurance minded rather than fire protection minded. Fire protection in any plant starts with the conviction that production capacity is worth more than insurance dollars. Fire protection buys *time* that dollars cannot buy.

b. Fire Protection Methods. The mechanics of fire prevention and control comprise a library full of standard texts, formulae and tables. Only the professional fire protection engineer can hope to know it all or to employ it effectively. No attempt will be made in this small pamphlet to give specific advice on technical matters as they apply to a particular plant. The advice of an expert on

fire protection should be sought if an expert in this field is not already a part of the plant staff.

In general, however, interruptions in production and destruction from fire can be prevented through good housekeeping, division of values, adequate physical barriers to prevent spread of fire, the elimination of fire causes, suitable first aid and fire equipment, and automatic sprinkler protection where products or process materials are combustible. In addition, the organization of a plant fire brigade, the establishment of a fire alarm service and the assurance of a thoroughly reliable and adequate water supply are essential.

c. The Fire Problem. Real fire protection starts with a survey of the plant and with realistic solutions of the so-called "fire problems." A fire problem is a hypothetical fire that starts under adverse conditions of time and place within the plant. The question is how can it be stopped before it gets out of hand. The solution of such a problem is not theory or guess work, but the application of expert knowledge to a particular task. The plant owner may obtain an impressive picture of the difficulties encountered in working out such problems by walking through his plant alone in the dead of night or on a Sunday. He should stop and think of what would happen if at that time an accidental or malicious fire got under way in his plant. How long would it be before someone found it? How would the finder report it? Who would respond? How would they get in? Where would they connect their hoses? How long would all this take? And during all that time, how fast would the fire be getting under way? The answering of problems such as these points the road to adequate plant protection.

d. Additional Emphasis in Periods of Alert and Hostilities. The fire hazards created by normal production methods are supplemented in time of alert or actual hostilities by risks arising out of the national emergency.

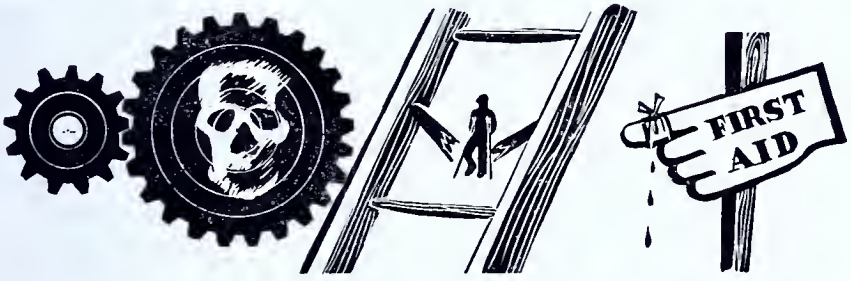
(1) The pressure to get out more work creates conditions that breed fires and make them spread. Taking chances with critical plants is not only bad business judgment but bad defense planning.

(2) Fire has always been the favorite tool of the saboteur. Time delay ignition devices give him a chance to escape. The destruction that follows hides his tracks. In addition to starting a fire in a vulnerable spot, the saboteur may effectively sabotage fire prevention devices. The saboteur counts on the weaknesses of the plant's fire

protection measures for his success. The operator of a critical plant must assume that his plant is a target for sabotage and must realize that he needs advice from experts in fire protection. Fire protection measures visualized by the average plant operator will not suffice. It is not that the saboteur is smarter than the average plant operator, but in such a case the saboteur is a specialist working against an amateur.

(3) Fire protection planning must also take cognizance of the additional threat created by the possibility of direct enemy action. This phase of fire protection is discussed in Chapter IV.

e. Employee Cooperation. No campaign of fire protection may succeed without the complete cooperation of all plant employees. Fire protection needs the help of every workman in the plant. The idea must be sold and interest maintained. One absolute requisite of employee participation is constant and free contact between all employees and the fire protection force.



5. Accident Prevention.

a. General. Injuries to personnel result in serious delays in production, destroy morale, and are expensive in time, money and manpower. In terms of lost production and manpower, the drain through accidents represents an army of more than one million persons who might actively be employed, but who are constantly away from their jobs because of injuries. The magnitude of the accident problem has demanded aggressive organized effort, and accident prevention authorities, such as the National Safety Council and compensation insurers, have vigorously promoted programs to control and reduce personal injuries.

b. The Aim of Accident Prevention Programs. Accident prevention work is essentially a simple and understandable proce-

dure. Most accidental injuries result from two causes—(1) the violation of commonly accepted safe practice rules; and (2) exposure to mechanical or physical hazards. Accordingly, accident prevention is designed to eliminate or reduce exposure from these two hazards by means of employee indoctrination and the employment of physical safeguards.

c. Employee Indoctrination. The great majority of industrial injuries occur because employees violate common accident rules or assume unwarranted personal risks. Mechanical safeguarding of physical hazards, while necessary and important, can accomplish only a small degree of personal injury reduction, unless it is a part of a constant campaign aimed at inspiring the individual to safeguard his own personal safety. In any safety program, aggressive efforts must be made to devise practical methods of creating safe working habits on the part of all employees, and a positive will to abide by prescribed safety procedures. The maintenance of such a specific campaign becomes the primary safety activity of each business that is large enough to warrant a full time safety staff. Techniques and methods for this type of campaign may be found in the literature of nearly all trade associations and are made available to plant management by compensation insurance companies, State Labor Departments and the National Safety Council.

d. Physical Safeguards. The most careful worker is nevertheless likely to sustain injury if he is exposed to hazard without adequate personal protective equipment or physical safeguards while engaged in an operation which requires such type of protection. In a plant properly organized for accident prevention, guarding of hazards by mechanical devices becomes a matter of routine. Buildings and other structures are designed for safety; dangerous moving parts of machines, tools and other mechanical equipment are guarded; safe housekeeping is maintained; devices and techniques especially designed to permit safe operation under all conditions are employed. The designer builds in, or purchases equipment having safety devices which meet the standards of the American Standards Association, National Safety Council, or other recognized organizations.

e. Organization for Safety. The modern industrial safety organization centers around a safety director, safety inspector and safety committee. The safety director, as the direct representative of management, plans and directs all safety activities and is responsible to management for the effective functioning of the

safety program. Safety inspectors survey structures, yards, storage spaces, machines, tools, equipment, materials, safety appliances and equipment, and safe work performances; they report their findings and recommendations, or if necessary, correct unsafe conditions and systems on the spot. They also investigate accidents, prepare records and assist generally in safety work.

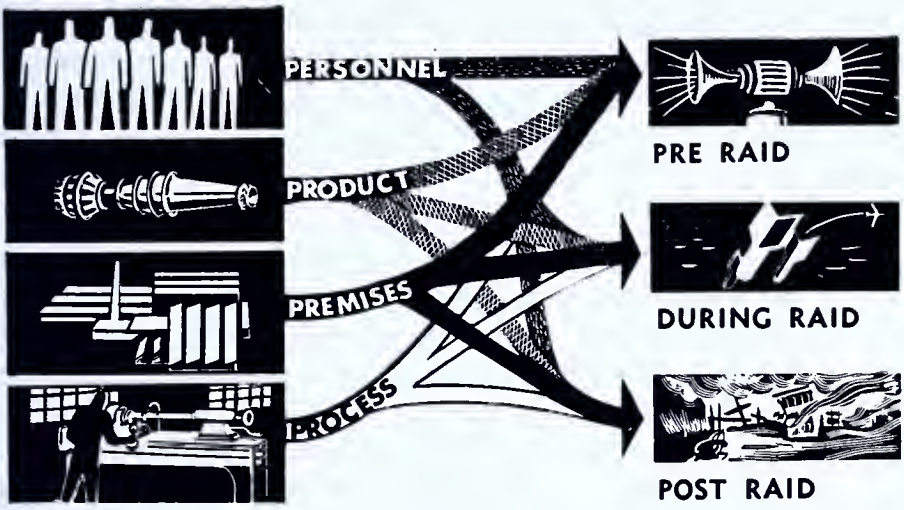
The safety committee serves as a clearing house and forum, considering (1) the program of safety works; (2) recommendations from all sources; (3) accident investigations; (4) the quality of safety work by all participants in the program; (5) educational and promotional activities; (6) the correction of outstanding mechanical and physical causes of accidents; and (7) increased risks in emergencies. In times of emergency, when production is being raised, the safety problem becomes more acute because of—

(1) The employment of new and untrained people.
(2) The congestion caused by increased output.
(3) A mental attitude of "hurry at all costs."

This means that the maintenance of an adequate safety program should become a primary activity of each business. All plants and facilities which have not already done so, should expand their safety programs to include:

(1) An effective safety organization.
(2) An intensive educational program to establish safe employee working habits and safety thinking.
(3) Intensive shop supervision.
(4) Disciplinary control of unsafe working practices by employees.
(5) Maximum use of proper protective equipment and clothing.
(6) Special provision for guarding against physical and mechanical exposures.
(7) Adequate first aid and medical facilities.
(8) Accident records sufficient to evaluate the effectiveness of the program and the progress made.

If both management and employees work wholeheartedly together in the plant safety program, the results will be clearly apparent in the reduction of personal injury and the consequent increase in production.



CHAPTER IV

Defense Against Direct Enemy Attack

1. General. The responsibility for defense against direct enemy attack rests with our Armed Forces. However, it must be assumed that some enemy attacks will get through those defenses, and it is then that defensive measures on the part of plant owners, if properly planned and implemented, will reduce losses to personnel and equipment. In Chapter II it was pointed out that these attacks might take the form of air attack, chemical attack, and biological and bacteriological warfare. The measures against the various types of air attack here discussed are based on studies made in England, Germany and Japan. It is realized that it is not practicable for every plant to install all or even most of these measures. The degree of utilization is a matter to be decided by individual plant management based on practical considerations of need and funds available.

2. Air Attack. The principles governing defensive measures against air attack by atomic, high explosive, and incendiary bombing are essentially the same. There are two main types of defense which contain all the known measures against air attack, these being *active measures* and *passive measures* or *protective construction.*

a. Active Measures. Aside from the direct defensive action of the Armed Forces, active measures include the organization and utilization of trained personnel to deal with practical problems

arising in an emergency. Most of these measures can be established in all plants regardless of size or type at no substantial cost, and require no additional personnel. They assure control, rescue, first aid, evacuation and limitation of damage. They are as follows:

(1) *Control.* Every plant protection organization in wartime should be composed of groups of employees, each of which has been assigned special duties in the event of an emergency. To operate effectively, these groups must be centrally directed by a single person who is responsible for the organization as a whole. It is suggested that this person be called the "Defense Coordinator." In small organizations, direction can be exercised by the issuance of orders directly from the Defense Coordinator to the individuals who are to carry out the instructions. In large organizations, composed of many units operating at widely scattered points, some means must be devised to enable the Defense Coordinator to know all that is happening in the area under his jurisdiction and to send orders quickly and accurately to all units under his direction. This system is known as the "Control System." It is directed from one point, known as the "Control Center."

The control system should provide—

(a) A suitably protected headquarters or control center.
(b) A reporting system to keep the Defense Coordinator constantly informed during an emergency or disaster.
(c) Communications for the transmittal of orders without error and secure against enemy use to create confusion.
(d) Communication with local Civil Defense Headquarters.

The staff of a control system is usually composed of the Defense Coordinator and those responsible to him—the fire, guard, reserve medical, and other chiefs.

The control system is the most vital part of the protection system. It is the nerve center when an emergency arises and the whole plant protection organization must go into action. The control center should be carefully selected and located in a secure, convenient place, preferably underground. It should be protected against

sabotage, and afforded reasonable protection from bombing. It should be equipped with the necessary maps, charts, control panels, and communication systems (telephone, radio, messenger). There should be an alternate location for an emergency control center to function in the event of damage to the regular control center.

(2) *Air Raid Warning System.* Timely warning of an air attack is vital to control. Anticipation permits movement of employees to shelter areas, shutting down of equipment to reduce hazard to personnel and chance of damage, assembly of rescue, medical and emergency repair groups. The plant warning signal would be given by the control center on receipt of warning from the Air Defense or Civil Defense Headquarters. The plant Defense Coordinator should establish a working liaison with his local Civil Defense Headquarters for purposes of such warning.

(3) *Warden Services.* Wardens were vital elements in the plant protection organization of World War II. Increased destructive capabilities of air weapons, including the atomic bomb, indicate that the need for this type of service will be greater in future conflicts.

Organizationally, the plant warden service may be set up as an independent group under the Defense Coordinator or under the fire or plant guard chief. In any case, there should be a chief warden with a number of deputies depending upon the size of the plant.

Because of their responsibilities, wardens should be chosen with particular care for their qualities of calmness, leadership, and judgment. They must be level headed, resourceful, have the ability to inspire confidence, and know how to handle people. Their duties and responsibilities include—

(a) Leading or directing specific personnel groups to safety.

(b) Understanding all local warning and communication systems and carrying out assigned duties immediately upon order.

(c) Carrying out all blackout procedures, if required.*

* It is understood that area blackouts are not now contemplated by the Armed Services for the reason that present bombing techniques have made blackouts ineffectual.

(d) Spotting airplanes.

(e) Watching for fires.

(f) Administering first aid.

(g) Identifying different types of gases, bombs, and other hazards and taking the required protective measures.

(h) Assist in preventing or eliminating panic.

(4) *Fire Fighting.* The control of fires in case of an atomic attack would be comparable to that of the fire in San Francisco in 1906. Normal fire fighting forces would be inadequate and water supplies would be nonexistent or limited. An adequate defense would require reserves of equipment and personnel that could be brought in from unaffected areas in the vicinity. Clearly, fire fighting forces should be dispersed, and a mutual aid program between nearby cities is necessary. While fire fighting of this scope is beyond the sphere of plant personnel, liaison should be maintained with local Civil Defense Headquarters in order to facilitate the summoning of outside help.

In individual plants, measures to prevent fires, to put out incipient fires and to limit the spread of fires would reduce loss of life and damage. Consideration should be given to providing emergency supply of water for fire fighting in reserve tanks. However, these will only supply limited needs for water and primary dependence must be placed on methods of fighting fires that do not require water. Chemical extinguishers will be helpful in putting out incipient fires. Large fires can be controlled in some cases by creating adequate fire breaks. Japanese experience showed that fire breaks of limited width were ineffective.

Measures should be planned for extinguishing small incendiary bombs penetrating roof structures, by sand, stirrup pumps, or other appropriate means. Consideration must also be given to the extinguishment of plant fires started by the intense heat wave generated by an atomic bomb and by the disruptive effect of the blast of atomic or high explosive bombs. Particular emphasis should be given to the protection of fire prevention equipment from damage by an attack, for the loss of

such equipment may destroy the foundation of the plan for defense against fire.

(5) *Damage Control.* The problems involved in controlling damage are so varied that it is difficult to present helpful information. In some cases, equipment can be shut down, cut-off valves closed and hazards reduced. In other plants, process cannot be shut down without serious results. The steps that should be taken to reduce the damage from an attack, when operation cannot be assured, is a problem that only operating engineers with a detailed knowledge of local conditions can determine.

(6) *Rescue Services.* Every plant protection system must have a trained, adequately staffed and equipped rescue unit to work under conditions anticipated after attack. Members of rescue units should be trained in first aid and radiological defense.

Those who are selected for the rescue service squad must be men of common sense, unusually alert, of strong physique, have the ability to think and act quickly in an emergency and have a genuine feeling of responsibility and desire to aid their fellowmen.

(7) *Evacuation.* Rapid evacuation of personnel, vital data, and material is a problem seldom given the necessary attention. Planning for orderly evacuation of all occupants from hazardous areas will do much to prevent panic and save lives.

Plans designed to meet various kinds of hazards should be made. For example, some emergencies may require evacuation from the building or may simply require moving from one area to another within a building. On the other hand, air raids, atomic attacks, or attacks by special weapons will require different evacuation plans.

Alternate evacuation routes must be planned for use in event of obstructions. It may be necessary to provide transportation for personnel and critical material. Plant evacuation must be coordinated with any civil defense plans for community evacuations in order that plant employees may know that their families will also be removed from the danger area.

All the plant workers should be made familiar with the various plans for evacuation and should be drilled

for orderly evacuation in much the same manner as fire drills at schools are carried out.

(8) *Medical Service.* Plant facilities for emergency medical service should be studied to determine whether they would be adequate to care for a large number of seriously injured persons with outside assistance reduced by general demand. Plant medical facilities may be adequate to cope with ordinary industrial accidents, but they are not usually staffed or equipped to provide medical service in catastrophes.

It is assumed that, if emergency medical services have not been organized in a community, they will be organized before the outbreak of hostilities. A plan should be worked out by the physicians of the plant with the local chief of emergency medical service. It should be broad enough to provide for efficient service in the event of an emergency to the plant alone or to the entire community.

Details of the technical and professional aspects of the plan are not discussed here, but generally it should include—

(a) First aid at the site of the incident.
(b) Adequate ambulance service.
(c) Hospitalization of casualties.
(d) Transportation of casualties.
(e) Identification of casualties.
(f) Casualty stations.
(g) Sanitation service.
(h) Medical auxiliaries.
(i) Emergency supplies.

(9) *Radiological Defense.* In addition to the injuries from blast, falling structures and fire, which result from all types of air attack, the atomic bomb carries with it the additional danger of radiological contamination. Employees should be trained to—

(a) Know the insidious nature of all radiological dangers and comply strictly with all regulations issued for personnel protection.
(b) Avoid designated radiological hazards, areas, and routes.
(c) Make every effort to avoid bodily contamination from radioactive materials, avoid carrying these materials into shelters or on return to place of

work. Follow prescribed rules for personal decontamination.

(d) Take every possible precaution to prevent entry of radioactive materials into the body by—
Washing hands before handling food;
Eating no food that has not been checked for contamination;
Refraining from smoking; and
Covering open wounds.

(e) Help the wounded and rescue those trapped in the debris. (The human body does not become radioactive and there is no hazard in handling it.)

(10) *Emergency Repairs.* An emergency repair unit is an essential part of any plant protection system. The unit should be trained to repair damage caused by enemy attack without delay. Training or experience in repair and maintenance work, and adaptability to emergency work should be considered in selection of men for the repair unit. It should have a headquarters of its own with means of maintaining direct contact with the plant control center. Unit headquarters should be furnished with plans showing the layout of any equipment, service, or structure to be repaired. The locations of the stocks of parts needed for the anticipated repairs should be carefully selected to assure accessibility and convenience. "Safe Havens" should be established to contain duplicates of vital plans, documents, and essential material required to reestablish production if the plant is damaged or destroyed.

Crash helmets, gas resistant clothing, electric lanterns with spare bulbs and batteries, approved gas masks, and tools are essential equipment for the repair crew. If the plant is large, repair work would be expedited if tools and spare parts could be kept on a small truck available at all times.

It is suggested that the crew practice periodic trial runs in response to directions from the control center, so that the members will become familiar with the plant lay-out, establish routes to key points, and work out in advance as many problems as possible before a real emergency occurs.

b. Passive Measures or Protective Construction.

Passive measures or protective construction as used here embrace those precautions taken in connection with the construction, design, and layout of buildings which will afford to personnel and equipment protection against such destructive forces as blast, fragmentation, radiation and other effects of enemy air attack. These measures include dispersion, duplication, camouflage, personnel shelters, underground construction and similar measures designed to minimize casualties and damage to equipment. They vary in degree of protection and are necessarily limited by economic factors.

In the construction of new plants, an opportunity is presented for reducing chance of injury and damage by proper design. The main problem, however, will be with respect to plants now built; therefore, measures that are now applicable to existing plants are discussed first.

(1) *Protection of Vital Activities.* Studies conducted in Germany and Japan emphasize the need of protecting the means of control, rescue, first aid, fire fighting and damage control. Providing protected centers for these activities is an attempt to assure that these activities which are essential to reduce casualties and damage will be available for use after the attack. There are two general approaches to the problem. If fireproof, reinforced concrete or steel frame buildings are available in the required locations, advantage should be taken of the protection against blast and radiation that can be provided in selected areas of such buildings. If no such buildings are available, protected facilities can be constructed underground or in open areas where collapse of nearby buildings or fires would not affect them or prevent their use.

(2) *Communications.* Another service which is vital in getting things done and avoiding chaos and panic during and after an attack is communications. Normal communications will undoubtedly fail under attack. Telephone lines will be broken and all power may be off. Accordingly, an emergency system must be designed to provide for this eventuality. Radio transmission of orders or messenger services are possibilities.

(3) *Personnel Shelters.* Studies made in Japan indicate that large numbers of people killed in the atomic bombings

would have been saved if they had been in air-raid shelters. This does not mean that a shelter is a safe place during a bombing—no shelter is safe if it is in the center of an atomic burst, or suffers a direct hit from a high explosive bomb. Shelters are of great help, however, on the fringes of a hit. However, the cost of shelters to provide protection for all personnel is high. If shelter areas can be found in buildings offering considerable resistance to blast and radiation, this offers the most reasonable solution.

Shelters constructed below ground level provide lateral protection against blast and splinters and many of the other hazards, such as gamma rays which caused 20-30% of the casualties at Hiroshima and Nagasaki. Such factors as the following should be considered:

(a) The number of persons to be sheltered;
(b) Readily accessible entrances and exits;
(c) Sanitary accommodations; and
(d) Facilities for heat, light, etc.

Sources of danger such as the following should be carefully avoided:

(a) Excessive overhead loads of machinery or other heavy objects.
(b) Presence of water and gas mains, sewage systems, steam pipes, or pipes carrying refrigerants or noxious chemicals.
(c) Nearby storage of flammable or corrosive liquids.
(d) Multiple electric conduits and switchboards.

Assembly of large groups should be avoided and, if practicable, shelters should be dispersed so that a single hit will have a limited effect.

(4) *Reinforcement of Existing Plants.* A study of "The Effects of Atomic Weapons," mentioned in Chapter II, will show the effect of blast on structures. In some cases, stiffening of the frame against the lateral component of the blast will be possible and this will reduce the chance of collapse. A situation where this is practicable will be the exception rather than the rule. Probably the most important contribution that can be made in existing buildings is the reduction of the hazard from missiles. An examination of the structure will indicate fixtures, equipment, curtain walls, false ceilings and other fea-

tures of the buildings that might become dislodged by the blast and lateral distortion. These should be removed or safeguards installed that will prevent their falling and injuring workers and damaging equipment.

No adequate means of protecting against flying glass is known. The long duration of the blast resulting from an atomic explosion prevents the effective use of backing materials. The use of such materials probably would result in the greater hazard of blowing in the whole window. To a certain extent, small wire mesh that will permit passage of the blast yet stop the larger, more lethal, pieces of glass offers the best protection. If time permits, evacuation to shelter areas will eliminate or reduce this hazard.

Additional safety may be provided by constructing walls around tanks containing noxious or inflammable liquids to contain the outflow in case of rupture of tanks by blast action.

(5) *Design of new plants to minimize damage.* Greater safety against collapse of structures can be provided by considering blast effects in designing new buildings. National security may depend upon getting back into production as quickly as possible. If the frame of a steel building can be designed to withstand the blast even though the roofing and siding are lost, the time to get the building back in usable shape by replacement of the covering will be reduced.

Equipment should be designed so that distortion of the building will not affect it. For example, travelling cranes might have independent support.

The missile hazard should be reduced to the maximum extent by choice of design and materials. Plans might be made for shelter areas that will have a practical use as well as meeting shelter requirements when needed.

(6) *Underground Construction of Plants.* The best protection against blast and radiation can be provided underground. Dead storage of plans and records, spare equipment, jigs and fixtures in an existing mine is practical and desirable, and the maintenance of satisfactory humidity conditions in a closed space is not expensive. When suitably located, mines may be used for emer-

gency medical facilities or storage of medical supplies, reserve fire equipment and similar purposes.

In Europe, hydroelectric power plants and manufacturing facilities have been put underground at remarkably small increase in cost partially offset by reduced maintenance. Studies in this country have shown that underground manufacturing plants would be practicable and there are many existing mines with drift entrances suitably located with respect to transportation and labor for such use.

(7) *Camouflage.* The part to be played by camouflage of industrial plants in future defense efforts has been reduced by radar techniques. Visual observation may, however, be important in attack and consideration should be given to making an isolated vital plant as inconspicuous as practicable consistent with other factors involved. If it is located in an industrial center which may become a general target area, then individual effort would have little importance.

3. Bomb Reconnaissance and Disposal.

Unexploded bombs which may land on the premises during an air raid present a problem in disposal. Military bombs are made by mass production methods following one of several patterns and thus fall into recognizable groups. If the type and size of a bomb are known, its probable destructive capacity may be estimated.

It is recommended that the responsibility for bomb reconnaissance be assigned to a member of the plant police force, preferably with previous military experience along this line. It would be the duty of such an officer to (1) determine the exact location of the bomb; (2) verify that it is an unexploded bomb; (3) record all necessary descriptive data; (4) estimate probable damage in event of explosion; (5) prepare for immediate evacuation of the danger areas; and (6) call a local bomb disposal unit or the nearest military establishment and report the unexploded bomb and all information pertaining to it.

The foregoing does not apply to incendiary bombs which can be disposed of by regular and auxiliary fire-fighting forces.

In the disposal of unexploded bombs, the cooperation of civilian and military personnel is essential. In each Army area of the United States a special officer in charge of ordnance activities is responsible for bomb disposal within Army boundaries. Within

the Ordnance Department of the Army there are Bomb Disposal Units with personnel highly disciplined, trained, and skilled in disarming or unfusing bombs without exploding them. The Chemical Corps of the Army is responsible for cooperation with the Ordnance Department in training military and civilian personnel in identifying and handling chemical bombs.

The local civil defense organization may have a trained bomb disposal unit. If no such local bomb-disposal unit is available, then the Military Units will probably undertake this work to the limits of their capabilities.

4. Defense Against Chemical Attack.

However reluctant one might be to undertake a program of organized gas defense, it is clear that people who are well-trained and well-informed on anti-chemical measures will largely nullify the effectiveness of enemy gas attacks. Thorough preparation is the most certain way to reduce casualties. If such preparation could be undertaken on a large scale throughout the country, it might even discourage the enemy's use of war gas entirely.

Defense against chemical attack must rest upon a technical knowledge of the special chemical employed. Defense good against one type of chemical will not be effective against another type. It is feasible at this time, therefore, only to outline a few general principles of defense against chemical attack. The extent and character of specific countermeasures to be employed by the plant must await future developments.

Lethal gases, vesicants, lachrymators, and bronchial irritants were widely used during World War I. Individual protection against such chemicals requires the use of appropriate gas masks and impregnated clothing. Indubitably such equipment must be made available for repair and rescue workers who may be required to enter an area where gas is encountered. It will probably be economically and physically impossible to furnish such equipment, however, to all the personnel in the plant. Accordingly, at this time it would appear that protection against chemical attack for any large number of persons must rest upon the use of chemical-proofed shelters. Should the enemy use one or more of the persistent war chemicals, for example, mustard gas, then provisions must be made to decontaminate individuals on their arrival at the shelter and to decontaminate the affected areas.

All of these matters are highly technical in nature and, in the event of imminent peril of gas attack, must be placed under the supervision of a well-trained and experienced technician. This

individual will operate as Chief of Chemical Defense of the plant and, in addition to supervising the gas-proofing of shelters and the rendering of first aid to chemical casualties, he must be prepared to establish a training program designed to give employees—

a. A fair knowledge of war gases likely to be encountered and the precautions to be taken in each case.
b. An understanding of the use and capabilities of the gas mask.
c. A basic understanding of decontamination methods for destroying war gases.
d. A thorough understanding of the first aid measures to be applied in the treatment of gas casualties.

In some cases, the Chief of Chemical Defense may need a properly trained group to assist him in his work.

Another danger which should be borne in mind is that which may arise from partial destruction of a chemical plant in the immediate vicinity. Toxic gases from a neighboring plant can be just as deadly as if loosed by the enemy. The Chief of Chemical Defense should make a survey of nearby plants to determine what hazards are present in this respect and what countermeasures are necessary.

It is important that the Chief of Chemical Defense establish liaison with the local Civil Defense Unit for purposes of obtaining information and assistance with respect to training, and medical help in the event of a gas attack.

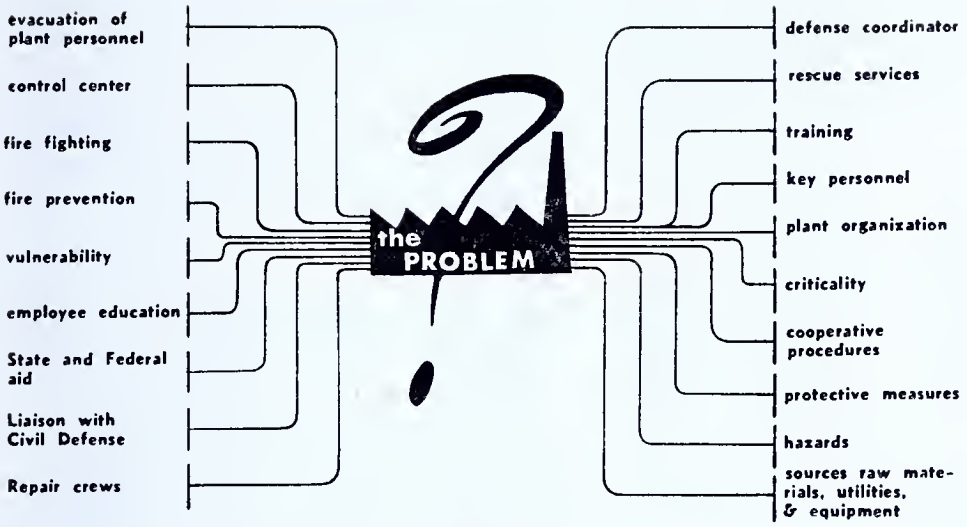
5. Defense Against Biological or Bacteriological Attack.

Despite common opinion, biological warfare is not immediately and widely destructive. Its effect can be minimized and counteracted by specific medical treatment. Application of normal or intensified public health measures will generally retard infection and prevent attack from reaching epidemic proportions. Defense against biological warfare depends on early identification of the disease, and prompt countermeasures to prevent further spread. Obviously defense must be planned well in advance of attack.

Disease germs can be disseminated by contact, by infecting water systems, animals, crops, bulk food supplies, and air circulating systems. Defense measures must provide for the isolation and treatment of the infected persons or animals, the protection of water purification and sanitation systems, thorough investigation of the loyalty and health of individuals handling bulk food sup-

plies, thorough cleansing of foods before being divided into small packages for sale, and filtration of the air circulating systems.

While defense against a general biological attack will generally originate outside the plant, it must be recognized that the working force within a critical plant may be sabotaged by biological means by attack upon the plant's drinking water, food, ventilation and sanitation facilities. Furthermore, the plant will be required to initiate measures within its capabilities for the protection of the health of its employees in case of a general attack. One person within the plant protection organization should be responsible for giving warning in case of a biological attack, and for coordinating protection. This person should have some training in bacteriology and be a member of, or have close contact with, the plant or community medical group. If he is not capable of immediately recognizing specific types of biological attacks, he should call the nearest authority. It is assumed that, in the future, the Federal Government will provide simple but accurate methods of identifying these weapons and improved methods of defense against them.



CHAPTER V

Administration of Plant Protection

1. Administrative Responsibility.

The degree of organization for plant security will depend almost entirely upon the size, criticality and vulnerability of the plant, the number of its personnel, and the added cost which may be assumed for this operation.

However, successful plant protection depends upon the interest and skill of those who devise and administer the program. It requires complete coordination between management and workers, and between the plant and the community and government. In broad outline the development of the program should proceed upon the following lines:

a. Analyzing the criticality and vulnerability of the plant and community to determine how great are the hazards and where the hazards are most likely to develop.
b. Analyzing the existing plant protection system to determine the adequacy of the system in the light of the hazards involved and to establish such additional protective measures as may be necessary.
c. Training employees to observe plant protection regulations and to understand the reasons and purposes of the various regulations.
d. Training key personnel in plant protection functions so

that they may organize and direct workers under them in emergency.

e. Establishing and maintaining cooperative procedures between management and workers to secure suggestions and information from workers, assign protective responsibilities, and aid in the harmonious and efficient operation of the program.
f. Publicizing the protection system and its objectives by advertising and public relations techniques.
g. Establishing coordinated working relationships with the entire community civil defense organization.

The proper discharge of the foregoing functions, as well as the vital importance of the matter to management and workers, requires that the responsibility for plant protection be placed in a position of top level authority so that safety and security problems will receive equal consideration with production, sales, and other management functions.

2. The Defense Coordinator.

The complexity of the problems of plant protection clearly points to the necessity for delegating to one individual the responsibility for plant protection operations. Whether the assignment of this individual is full or part time depends upon the size and nature of the facility. A suggested title for this individual is "Defense Coordinator." The duties of the Defense Coordinator, prior to commencement of actual hostilities, will be:

a. To analyze the need for and to devise plant protection measures.
b. To administer and supervise the operation of the plant protection measures.
c. To organize and train employee service groups.
d. To educate employees in plant protection and to develop employee cooperation and assistance in all phases of the plant protection program.
e. To maintain liaison with local civilian defense agencies and to integrate the plant and its programs and organizations into the community civil defense plan.
f. To maintain relations with other plant defense coordinators to enable mutual assistance in the solution of problems and the sharing in emergency, of supplies, equipment, productive capacity, and personnel.

The duties of the Defense Coordinator after the commence-

ment of hostilities will include all of the foregoing duties, and in addition, the responsibility for directing and coordinating all plant services in the event of attack, including fire-fighting, damage control, rescue, evacuation, and medical services.

3. Utilization of Existing Facilities.

Emergency plant protection programs should be based by the Defense Coordinator, to the extent feasible, upon existing programs maintained as part of the normal business practices of the plant involved. Such programs must be increased in intensity, however, to meet war time conditions, and should be continuously supplemented as necessary by additional measures.

An emergency organization for which no counterpart is found in existing facilities programs must be developed to afford the necessary emergency services for the protection of employees and property during and after direct attack. In the establishment of the emergency protection program, full use should be made of the existing service departments, such as fire, medical, repair, and guard organizations. The departments should continue to function as usual, coordinated and guided by the Defense Coordinator, except in emergency, at which time they should operate as a unit of the emergency protection program under the full administration of the Defense Coordinator. The personnel of these units should be augmented as necessary, and trained to cope with the new types of emergencies, arising from war conditions, which they are expected to combat.

In addition to the normal services, the emergency organization should consist of organized and trained volunteer groups. In selecting volunteers, preference should be given to those persons whose natural talents and training will most nearly fit the task assigned, and whose duties are such that they may be released in an emergency with as little disruption of production as possible. Persons so selected should not be committed to outside civil defense activities which conflict with their assignments. Highly skilled men in key positions should not be selected for this type of work. The details of selection should be worked out by the Defense Coordinator in cooperation with the local civil defense organizations.

A complete program should be immediately planned by the Defense Coordinator so that measures in effect at any given time may be increased successively in accordance with the preconceived plan, as the risk of actual hostilities increases. The Defense Coordina-

tor's objective should be to have the entire program in full force and effect as near as may be to the actual opening of hostilities. The Defense Coordinator must recognize that the degree of activation of the plant measures planned must be continuously revised in the light of factors set forth in Chapter III.

4. Considerations in Planning.

The Defense Coordinator and plant personnel must not be discouraged by the magnitude of the problem with which they are confronted. Nor should they be discouraged by the inability of their particular plant to put into effect on a large scale all or a substantial part of the measures discussed in this pamphlet. The information set forth herein is derived primarily from experience in World War II, but the Coordinator may be able to devise means of accomplishing plant protection superior economically and in efficiency to those heretofore employed. Certainly in the field of atomic, chemical, or biological attack, published experience furnishes little or no guide to the practical solution of the problems presented at the plant level. It is believed that more specific and detailed measures in these fields will be developed as a result of planning by industry and governmental agencies. The main objectives are that:

a. An effective, aggressive plant organization be set up now to study the problem.
b. Management and labor understand the scope and character of the hazards and appreciate the necessity for positive protection measures.
c. Planning be prosecuted actively at plant level without reliance upon government for initiative or specific direction.
d. Protective measures be put into effect as rapidly as possible within the practical capabilities of the plant.

5. Help of Local and State Civil Defense Agencies.

A working relationship should be established with the activities of local and state civil defense agencies. For example—

Details regarding warning of an air attack should be worked out with the local civil defense headquarters;

Fire services should be arranged for with the town or municipal fire department;

Medical and welfare services should be established through the County Coordinator of the State Civil Defense Commission;

Post-raid activities should be adapted to local and state programs.

Know your local civil defense coordinator. Work with him—he can help you. Help him to help industry generally in your area. He will have advice from a plant protection advisory committee or panel. Remember he is responsible for an "area"—you are in that area. He must count on *you* to do your share *within* the plant for there it is your responsibility. He can be helpful but he can neither "boss" you nor do things for you *inside* the plant. However, he (or some agency of local government) has a responsibility for prevention of damage to your plant from *outside* your plant.

6. Help of Other Agencies.

Take your problems of *internal* protection up with the proper agency of government. For example—

Investigations of espionage or sabotage with the Federal Bureau of Investigation;

Criminal matters with the local police;

Fire prevention and fire fighting measures with the National Board of Fire Underwriters or the National Fire Protection Association;

Safety and accident prevention programs with the State Department of Labor and Industry and the National Safety Council.

7. Military and Civil Defense Commission.

When you are in doubt about the answer to a problem or where to take that problem, take it to the office of the Military and Civil Defense Commission in Harrisburg. In that office, there is an *active, operating,* and *staffed* Plant Protection Division, available for help and advice. Bring your problems to it.

CHAPTER VI

Plant Protection Survey Report

In the following pages, there is included a suggested or model Plant Protection Survey Report. It is offered as a guide in making an inspection of a plant to reveal deficiencies in security, whether related to potential sabotage or accidental damage through fire or personnel hazards. All questions on the form will not be pertinent to every facility—whenever this is the case, you may write in "Does Not Apply" (D.N.A.) on the form.

PLANT PROTECTION SURVEY REPORT

PLANT NAME _____

Subsidiary of _____

Raw Stock _____

Located at _____

Usual products _____

Date of inspection _____ Proposed reinspection date _____

Inspected by _____

(Underline the Word or Words Which Apply)

I. FIRE PROTECTION (for the prevention of interruption of production):

A. Housekeeping Conditions Poor Fair Good Excellent
Disposal of Waste Material Poor Fair Good

B. Construction:

1. Buildings: Floor area _____ sq. ft. Number of buildings _____
Floor area devoted to defense production _____ sq. ft.
Maximum height _____ stories, mostly _____ stories

Floor construction above ground _____ % hollow joist; _____ % open joist; _____ % plank on steel; _____ % plank on timber; _____ % concrete or gypsum; _____ % _____

Roof construction: _____ % hollow joist; _____ % open joist; _____ % plank on steel; _____ % plank on timber; _____ % concrete or gypsum; _____ % _____

Wall construction: _____ % frame; _____ % masonry; _____ % _____

2. Fire areas: Subdivision of area by walls and partitions Poor Fair Good

3. Floor Cut-offs (at stairs, elevators, etc.) Poor Fair Good
Firedoors: Scant Ample Maintenance: Poor Fair Good
Maintenance and repair of buildings and equipment Poor Fair Good

C. Protective Equipment:

1. Automatic sprinklers fed by: Public mains Tank Private reservoir Pump
Pressure on highest sprinkler _____ lb. from Public mains Private reservoir Bottom of tank
_____ % Floor area sprinklered; _____ % needing sprinklers
Dry pipe systems Poor Fair Good

Water flow alarms: Local Central station Public fire department

Equipment and probable response: Unreliable Reliable

Main control valves: Located outside Inside Central station supervision

Inspections: Made Daily Weekly None Poor Fair Good

2. Fire-fighting equipment: Condition Poor Fair Good
   Supply Poor Fair Good
3. Yard hydrants: Number _____ Scant Ample
   Maintenance Poor Fair Good
4. 2½-inch cotton rubber lined hose: Amount _____ ft.
   Scant Ample
5. Private fire brigade: Number of men _____; frequency of drills _____; probable efficiency Poor Fair Good
6. Public fire department: Paid Volunteer Means of Calling _____ probable efficiency of Public Fire Department
   Poor Fair Good

D. Water Supplies

1. Public water: Diameter street main _____ in. Diameter yard connection _____ in.
   Static pressure _____ lb.; residual pressure _____ lb.; with _____ G.P.M. flowing
2. Tank or private reservoir: Capacity _____ gal. Elevation _____ ft. Full _____ Condition: Poor Fair Good
3. Fire pumps: Number and capacity _____
   _____
   Type: Underwriter Centrifugal Electric Steam Gasoline _____Reliable
   Suction _____ft. lift; _____ft. head; _____liable to obstruction
   Suction reservoir capacity _____ gal. Full? _____
4. Probable number of good 1⅛-inch streams all sources can simultaneously furnish at any point in yard (include pumpers first alarm only) _____
5. Total volume of water available Poor Fair Good

E. Occupancy:

1. Nature of special hazards _____
   _____ Safe Unsafe
2. Electrical maintenance Poor Fair Good Excellent
3. Storage and use of inflammable liquids or gases Safe Unsafe
4. Stock, storage, or finished goods exposed to manufacturing hazards is _____ excessive
5. Welding practices Safe Unsafe
6. Storage arrangement of dies, jigs, gages, patterns
   Poor Fair Good
7. Smoking discipline Safe Unsafe

F. Final Ratings on Prevention of Fire:

General interest Poor Fair Good Excellent

Exposure to local conflagration Bad Considerable Slight None

Protection against local conflagration
Poor Fair Good Excellent

Extent of automatic sprinklers None Poor Fair Good
Total fire protection Poor Fair Good Excellent
PROBABILITY OF FREEDOM FROM INTERRUPTION OF PRODUCTION CAUSED BY FIRE OR EXPLOSION
Poor Good Fair Excellent
(General remarks and recommendations should follow at the end of report)

II. Investigation of Personnel by Management:

A. Records Checked:
1. Previous employers? _____ 2. Police? _____
3. What local credit associations? _____
4. School? _____ 5. Parental background? _____
6. Evidence of citizenship? _____
7. Before or after employment? _____
8. Other methods of knowing antecedents or personal habits _____
9. How far back in employee's experience is check made? (Give number of years and area of investigation) _____
10. Does application for employment used by the company include all points covered in Plant Protection Manual? _____

B. Records Made: Fingerprints Photographs Is physical examination made? _____

C. Is investigation made of contractor's employees working on the premises? _____

D. Is investigation made of caterer's employees working on the premises? _____

E. Are caterers given food-handlers' examinations? _____

F. Composite rating—Investigation of personnel
Poor Fair Good Excellent

Comment: _____

III. Employees:

A. Personnel data:
1. Total number _____; first shift _____; second shift _____; third shift _____
2. Number of aliens _____ 3. Aliens on government business _____; on classified or aeronautical contracts _____
4. Has approval been secured from Secretary of War for all aliens working on classified or aeronautical contracts? _____

5. Number of foreign born _____ Give predominant nationalities
_____
_____

6. Are there any important foreign or racial groups living in the vicinity? If so, what? _____
_____

7. Absences checked? _____
8. What unions? _____
National union affiliation _____ Independent union _____
Closed or open shop _____
9. Labor turnover _____
10. Management considers labor relations
Poor Fair Good Excellent
11. Inspector considers labor relations
Poor Fair Good Excellent
12. Morale of employees Poor Fair Good Excellent
13. Are provisions of espionage and sabotage acts called to attention of each employee? _____

B. Accident Prevention:
1. General interest, management and employees
Poor Fair Good Excellent
2. Safety committee activities Poor Fair Good Excellent
3. First-aid and medical facilities Poor Fair Good Excellent
4. Supply and use of safety equipment
Poor Fair Good Excellent
5. Composite rating—Employees Poor Fair Good Excellent
Comment _____
_____
_____

IV. Physical Control:

A. Describe briefly general plant layout _____
_____
_____
_____
_____
_____

B. What provision for employee parking: Inside plant area? _____
_____ Outside plant area? _____
Restricted Supervised Satisfactory

C. Is plant fenced? _____ Poor Good

D. Windows, skylights, coal chutes, sidewalk elevators, railroad spurs, and right-of-way protected? Comment _____
_____
_____
_____
_____

E. Exterior floodlighting _____ Poor Fair Good Excellent

F. Are vital areas: Restricted? Guarded? Protected? Satisfactory?

G. Are technical and precision tools properly protected and charged out when issued? _____

H. Are transformers and switchboxes adequately protected? _____

I. Are air compressors vital? _____ If so, are they protected? _____

J. Is movement of employees through the plant restricted? _____
Describe method of restriction _____

_____

_____

K. Do employees pass through restricted areas in order to reach restrooms and cafeterias? _____

L. Are clothing and lunchboxes kept out of important plant areas?

_____

M. Comment as to adequacy of physical provisions made to restrict entry or exit _____

N. Emergency exit facilities: Inadequate Adequate

O. Transportation facilities (highways, railroads, waterways, etc.—state methods and carriers used) _____

_____

Are shipping entrances protected? _____

Is a log kept of all trucks and deliverymen entering plant yard? _____

P. Describe area surrounding plant, paying particular attention to conditions or buildings of questionable character which might be used for sabotage or espionage activities _____

_____

_____

_____

_____

Q. Is water supply important for manufacturing purposes? _____
If so, is water supply adequately protected? _____
Comment _____

_____

_____

R. If the company uses explosives (in any significant quantity) is the handling of these in accordance with recognized safe practices? _____

_____

_____

S. Composite rating—Physical control is: Poor Fair Good Excellent
Comment on physical control and state what provisions have been made for blackout, evaluating the measures taken _____

_____

_____

_____

_____

_____

_____

V. Power:

A. Types used: (Describe) _____

B. Electric Power. Peak Load _____ kw., kva.
Generated on premises _____ % Generating capacity _____ kw., kva.
Purchase from others _____ % Name Utility _____
Main transformers: Number _____ Capacity _____ kva. _____ Safe location _____ Protected
Power lines: Number of independent feeds _____: Pole line, underground; with _____ lightning protection: safe _____ reliable.
Circuits _____ overloaded. National Electric Code _____ followed.

C. Power House: _____ Safe arrangement _____ adequately protected.
Admittance _____ restricted. _____ constantly attended.
Number steam boilers _____ Total horsepower _____

D. Composite rating power reliability Poor Fair Good Excellent
Comment _____

VI. Identification:

A. Employee identification: Badges Cards Photos Personal recognition
Is design of badge and cards in accordance with recommended practice? _____

B. Enforcement is Poor Fair Good Excellent

C. Visitors: Registered Accompanied Identified
Identification recovered upon departure _____ Is adequate information about the visitor and the purpose of his visit obtained? _____
Are subcontractors' employees subjected to the same rules and regulations as regular employees? _____

D. Composite rating—Identification is Poor Fair Good Excellent
Comment _____

VII. Guards:

A. Number of guards_____ B. Number of guards on each shift_____

C. How equipped _____
Condition of equipment is Poor Fair Good

D. Properly trained in duties _____

E. Adequacy of supervision _____ F. Average age _____

G. Physically qualified _____

H. Are guards thoroughly investigated before hiring? _____

I. Do guards inspect: Trucks? Railroad cars? Containers and packages? Conveyances?
Do guards supervise loading and unloading of railroad cars and trucks? _____

J. Do guards check the credentials of every employee entering the plant? _____

K. Are guards issued regulations, instructions, and telephone numbers for use in an emergency? _____

L. Are records maintained reflecting all activities during each shift of guards? _____

M. Are guard forces or watchmen on duty for 24-hour periods? _____

N. Comment on adequacy of guard patrol _____

O. Other duties of guards _____

P. Comment on communication system for guards _____

Q. Frequency of recorded workmen's rounds during idle periods _____
All areas are _____ covered adequately.

R. Type of watch-clock or burglar alarm _____

S. Composite rating—Guard system is Poor Fair Good Excellent

VIII. Plant Business:

A. Restricted mail room Poor Good

B. Mail handled by trusted employee _____

C. Confidential blueprints handled Poor Good

D. Blueprints and tracings protected from fire _____
Returned to file and properly locked at night _____

E. Is a carefully supervised charge-out system for blueprints, photographs, formulae, performance charts, and confidential documents in effect? _____
Comment _____

F. Is the custody of keys and safe combinations restricted to trusted employees? _____

G. Is the use of telephones by employees restricted to company business? _____

H. How is the waste paper disposed of? _____

I. Are janitors and charwomen supervised? _____

J. Are special tools, jigs, dies, and patterns properly stored and charged out? _____

K. Is production laid out in a manner which will permit an efficient flow of production with a minimum of employee movement between departments? _____

L. Is management fully aware of provisions of AR 380-5 for the safeguarding of military information? _____

M. Does management enforce compliance with AR 380-5 among key personnel who handle confidential material? _____

N. Composite rating—Handling plant business is

Poor Fair Good Excellent

_____

_____

_____

_____

IX. Summary of Composite Ratings:

Composite rating—Plant protective status is

Poor Fair Good Excellent

_____

_____

_____

_____

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